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Suggestions for Forest Planting

in the

Northeastern and Lake States.

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SUGGESTIONS FOR FOREST PLANTING IN THE NORTHEASTERN AND LAKE STATES.

THE REGION.

The suggestions contained in this circular are applicable to the New England States, New York, New Jersey, all of Pennsylvania except the western portion, Michigan, Wisconsin, and eastern Minnesota.

ADVISABILITY OF FOREST PLANTING.

While the need for tree planting has not been felt in New England and the Lake States as keenly as in the treeless West, large areas of land within this region are fit only for forest growth. From an economic standpoint it is important that these lands should be put into a state of productiveness. Extensive forest planting has thus far been somewhat discouraged by present methods of taxation and in part of the region by the difficulty in securing adequate protection from fire. The true value of forest land and its rightful place among the permanent resources of the State are, however, becoming recognized, and an enlightened public sentiment is rapidly making this form of investment safe and profitable.

CUT-OVER LANDS.

Throughout the Northeastern States and the Lake Region are large areas of forest land which have been lumbered and afterwards swept by successive fires. Repeated burnings have destroyed all young trees of valuable species, and these have been succeeded by stands of aspen, wild red cherry, scrub oak, red maple, and shrubs. Such land presents to the tree planter a difficult problem, because not only will the expense of the initial planting be rather high, owing to the dense growth already on the ground, but the young trees are likely to be overcome in competition with it. Added to these difficulties is the great danger from fire. This is especially true in the Lake States and Pennsylvania. The land is, however, worthless in its present condition, and where adequate fire protection can be provided forest planting is strongly recommended.

On recently cut-over areas which have not been burned tree planting is seldom necessary, for the more valuable species will usually come in without artificial aid. Cut-over lands which have recently been burned, so that the growth of worthless species is checked, offer exceptionally good opportunities for planting. Lands on which sprout or seedling growth is scarce or poorly distributed may be reforested by planting the bare areas.

WORN-OUT AGRICULTURAL LAND.

There is a large amount of land, particularly in New England and Michigan, which was cleared for farming, but which afterwards deteriorated in value, principally through loss of fertility. Throughout Massachusetts, Connecticut, and New Hampshire, many of these abandoned farms and old pastures grew up to white pine. This crop is rapidly being removed, and because no seed trees are being left, little natural reproduction is taking place. Such lands, because of their nearness to market and their freedom from brush cover, offer exceptionally fine opportunities for forest planting.

SAND DUNES AND BARRENS.

There are large areas of barren sand plains, notably in Connecticut, Rhode Island, New Hampshire, Massachusetts, New Jersey, and Michigan, which can not be tilled and which are a source of expense to their owners. These sandy lands are suited to the requirements of several hardy conifers, and, in many instances, will even support a good growth of white pine. As in the case of sand dunes, the problem is not one of purely commercial planting, but of preventing drifting sand from encroaching on valuable property.

WATERSHED PROTECTION.

Many large towns and cities store their water supply in lakes or reservoirs. Streams from bare watersheds flow in muddy torrents. Floods occur in the spring, and the water soon becomes exhausted in time of drought. As a result, there is likely to follow not only a water famine, but also an epidemic of disease, the germs of which find perfect conditions for development in the stagnant pools that are left by the shrunken streams. After the first heavy rain, these disease germs are washed into the reservoir below, contaminating the entire water supply. Water from slopes covered by forest is pure. Forests regulate the flow, prevent erosion and turbidity, and make waste areas beautiful and productive. Wherever natural reproduction can not be depended upon to cover the pastures and bare lands

of reservoir watersheds with forest growth, tree planting should be practiced. While the immediate object of this forest planting will be protective, timber crops will eventually be produced which will yield good profits.

THE WOODLOT.

Nearly every farm has at least a few acres which are of little value for growing agricultural crops. This land should be set aside for a woodlot and devoted to the production of fuel, fence posts, and timber for farm uses. Large open spaces in existing woodlots can be restocked with valuable species, thus making every part of the land productive. This is best done on lands from which the trees have recently been cut. In addition to producing wood material, the farm woodlot may, in some instances, be made to serve as a shelterbelt to protect the buildings or orchards from wind or snow.

METHODS OF PLANTING.

The best method of establishing a forest plantation is by the use of nursery stock. It is usually advisable to purchase plant material from a commercial nursery. In extensive operations, however, it may prove more profitable to produce the planting stock in a home nursery. Such a nursery, however, will demand the careful supervision of one experienced in growing young trees. Advice in regard to nursery practice is contained in Extract 376 from the Yearbook of the Department of Agriculture for 1905, which can be had upon application to the Forester.

Forest planting must be done by simple and cheap methods. Preparation of the planting site by plowing and harrowing is not essential, but is best if the land has been previously utilized for crops. Such preparation and cultivation improve the early growth of the trees, but add to the initial cost of the plantation.

Trees should be planted with the least possible exposure of the roots. The rootlets of the plant will dry out if exposed to the air for even a short time. This is especially true of conifers. Some of the broadleaf species may, with proper attention, live even after the roots have dried out, but conifers are far less likely to survive.

When the seedlings are received, they should be unpacked at once and their roots dipped into a pail containing thin mud. Until time for planting in the field the trees should be "heeled-in" according to the following method: Dig a trench deep enough to bury the roots and part of the stems. The trench should run east and west, with its south bank at a slope of about 30° to the surface of the ground. A layer of trees should be placed in the trench on its sloping side, the tops toward the south. The roots and stems should be covered with fresh earth dug from the second trench, in which a second layer of

trees is put and covered in the same way. The digging of the parallel trenches is repeated and layers of trees are put in until all have been heeled-in. (See fig. 1.)

In the case of conifers care should be taken not to bury the foliage, and either to choose a shady place for the young trees or to construct a shade over them with brush or laths.

The best time to plant trees is in the early spring, before the growth begins. In general, planting should be done as soon as possible after the frost is out of the ground. The trees should be carried to the planting sites roots downward in a pail containing several inches of water. They should be set in holes dug with a mattock. The width and depth of the holes will depend on the character and size of the plant's root system. In all tree planting it is of the greatest importance to press the earth firmly about the roots so that all air spaces are filled. The soil should not, however, be packed so hard as to be impervious to water, nor should the earth be raised in a mound about the stem.

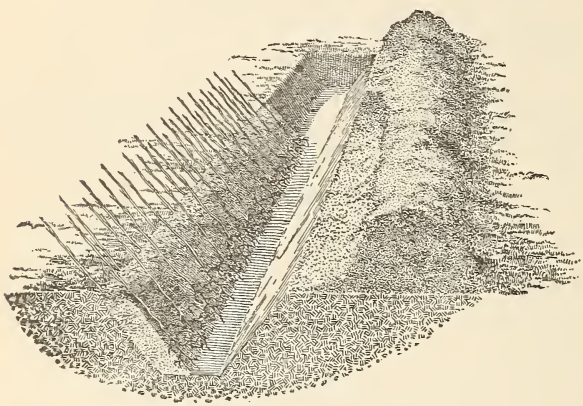

FIG. 1.—Heeling in young trees.

Information regarding general nursery practice and planting may be obtained from publications of the Forest Service, which will be forwarded upon request addressed to the Forester.

PROTECTION.

Protection to forest plantations must be assured before success is possible. Fire must be guarded against; otherwise the investment is likely to be a total loss. Local conditions must be such that the danger from fire is reduced to a minimum. Cattle must be rigidly excluded from the area planted, since grazing is decidedly injurious.

Plantations should be carefully watched to detect the presence of injurious insects. Insect damage should be reported promptly, and specimens of insects which attack the seedlings should be mailed to the Bureau of Entomology of the United States Department of Agriculture, which will identify them and suggest measures for their control.

SPECIES FOR PLANTING.

In general, conifers are best adapted for planting in the region, since lands which are to be devoted to forest are usually too poor to grow hardwoods profitably. Conifers produce a variety of material which is in great demand. They also are far superior to deciduous trees for protect e planting. To supply special demands in certain localities, it is sometimes desirable to grow crops of a particular species. Thus, willows may be planted for basket material or fine grades of charcoal; basswood and cottonwood may be grown for wood pulp, and black locust for fence posts.

Species which are well suited for planting in the region are white pine, red (Norway) pine, Scotch pine, jack pine, Norway spruce, European larch, tamarack, chestnut, sugar maple, and red oak.

WHITE PINE (*Pinus strobus*).

White pine is suitable for planting on nonagricultural lands throughout the region. Much of the abandoned farm land in the New England States may profitably be planted with white pine, and the tree is well adapted to burned and cut-over forest lands and to watersheds.

White pine grows best on a fresh, light, deep, and sandy soil with a porous subsoil. It will succeed, however, on a variety of soils, from fresh, medium-heavy clay and loam to dry sands. It will endure windy and cold exposures, but should not be planted near the seacoast, since it will not endure strong sea breezes.

Plantations of white pine are best established by the use of 3-year-old transplants. The trees should be planted 6 feet apart each way. They may be planted either pure or in mixture with shade-enduring hardwoods or conifers. It is essential, however, that the associated species should be of slower growth, since otherwise they will overtop and kill the planted pine. There are also certain light-demanding species of rapid growth which may be mixed with white pine. These, while they may overtop the pine, cast so light a shade that its development will not be retarded. The more important species for planting in mixture with white pine are chestnut, European larch, Norway spruce, red oak, and sugar maple. Ordinarily, white pine and the associated species should be planted alternately, so that the white pine will make up half the stand. In mixture with chestnut and European larch, however, white pine should constitute at least two-thirds of the stand.

Commercial plantations of white pine should be cut when from 40 to 70 years old. At this time the trees will be from 50 to 80 feet high and from 12 to 18 inches in diameter. The larger trees will

furnish saw timber, while the bulk of the plantation will find ready sale as box boards, pail staves, match blocks, wooden ware, and straight cooperage. Where there is a demand for small material, the stand may be profitably thinned at the age of 20 to 30 years.

Because of its thin bark young white pine is very susceptible to injury by fire. Between the fifth and twentieth years, however, the greatest cause of injury to the white pine is the weevil, which, in the grub stage, mines in the terminal shoot and causes a crooked stem. Repeated attacks make the tree unmerchantable.

RED PINE (*Pinus resinosa*).

Red pine may be planted on situations similar to those recommended for white pine. In form and rapidity of growth it is very similar to white pine, and because of its freedom from insect injury may sometimes profitably be substituted for it. The wood is valuable for all kinds of house lumber, and when chemically treated makes good posts and ties. It is somewhat stronger than white pine, and in the coal regions will be valuable for mine props. In most of its qualities it is somewhat similar to the shortleaf pine of the South.

Three-year-old transplants should be used and the trees planted 6 feet apart each way. Red pine is well adapted to pure plantations, but it may be mixed with European larch, chestnut, red oak, and sugar maple. The tree is very light demanding, and it is essential that associated species should not suppress it. To prevent this the other species should, in general, be of slower growth. European larch, however, though it grows faster than red pine, is a very desirable tree in mixture, since its crown casts little shade. When planted with red pine it should never exceed a proportion of one to three in the plantation. In all other mixtures red pine and the associated species should be planted alternately, so that red pine will make up half the stand.

SCOTCH PINE (*Pinus sylvestris*).

Scotch pine is native to Europe, though it has been planted to some extent throughout the northern United States. It resembles red pine, and although inferior to our white pine in many respects will often prove an excellent substitute. It is indifferent to soil requirements and is well adapted to planting on sterile sands and in exposed situations.

In this country, except for fuel, no practical use has ever been made of Scotch pine. Abroad it is one of the most important woods of commerce and furnishes the famous " red " and " yellow " deals of the

British timber trade. Although the wood is not durable in contact with the soil, large quantities are used for cross-ties and pit props, its value for such uses often being increased by impregnation with wood preservatives. Small-sized material is widely used for staves, heading, box boards, etc., but the largest use of the timber is for general construction purposes.

In planting, the trees may be spaced from 4 to 6 feet apart each way. The exact distance will depend upon the site. On somewhat unfavorable situations the closer spacing is advisable, but usually 5 by 5 feet apart is best. To secure proper form development the trees require considerable crowding while young; hence wide planting should never be practiced.

Although for favorable situations younger plant material may be suitable, the use of 3-year-old transplants is advised. Scotch pine may be grown either pure or mixed, but should never be associated with heavy foliaged trees of equal or more rapid growth. Suitable associates are European larch, Norway spruce, white pine, and red pine.

EUROPEAN LARCH (*Larix europæa*).

The European larch is not indigenous to the United States. It is a deciduous conifer similar in form and size to our native tamarack. Small plantations of larch have been made throughout the Northern States, and it is undoubtedly the most rapid-growing conifer suitable for planting in the region.

Larch requires favorable soil conditions. The soil should be deep, light, moderately fertile and fresh, and well drained both in the upper layer and subsoil. When the land is wet the tree may start vigorously, but it will soon become spongy at the base and rot. It will grow on comparatively poor soil.

The wood of larch is heavy, hard, strong, flexible, and very durable in contact with the ground. When grown on good soil it is yellowish white, but in cold, elevated situations it is reddish brown and much harder. Because of its strength and durability it is very valuable for posts, poles, cross-ties, etc., and is largely used in shipbuilding.

Plantations may be established by the use of 2-year-old seedlings. The planting should be done very early in the spring, since the buds start early. The trees should be spaced 6 feet apart each way.

Mixed plantations are most desirable, since European experience shows that pure plantations of larch do not thrive for any length of time. Chestnut and larch and red pine or white pine and larch are admirable for planting on a large scale. In such mixtures the larch should be in the proportion of one to three or more.

TAMARACK (*Larix laricina*).

Tamarack is a straight, slender, rapid-growing tree. Under favorable conditions it has been known to attain a height of 45 feet in thirty years, and at forty-five years after planting should be about 60 feet high, with a diameter of at least 18 inches.

No large commercial plantations of the tamarack are known to exist, and its use has thus far been limited to ornamental planting. The tree is well worth a trial, however, and plantations should prove profitable in many localities throughout the region.

The wood resembles that of red pine, but is somewhat stronger and stiffer. It is durable in contact with the soil, and is used for fence posts, ties, telegraph and telephone poles, and in the manufacture of canoes.

Tamarack thrives best on rich, moist, alluvial loam. Three-year-old transplants are suitable for planting. They may be planted in pure stands, but mixtures are advisable, with such species as white pine, sugar maple, and red oak.

Tamarack is one of the few species which will endure cold wet situations, but to plant it for profit on swampy lands is impracticable.

NORWAY SPRUCE (*Picea excelsa*).

Norway spruce, an introduced species, has been planted over a wide area in the United States. It is more rapid in growth than our native spruce and is well adapted for planting for pulpwood on cut-over lands of the Northeast. It will adapt itself, within certain limits, to situations formerly occupied by our spruce forests, and it is in many respects a superior tree.

In the United States little use has so far been made of Norway spruce. The timber is light, soft, nonresinous, and fairly durable. It works well, splits easily, and seasons without serious warping. Abroad, its largest uses are for construction timber, fuel, and paper pulp. Its utility for the last purpose should lead to extensive commercial planting in this country. The timber may also be used for general construction purposes as a substitute for white pine. It is very suitable for windbreaks and may be planted as a protection belt about exposed hardwood groves.

Norway spruce does not demand a deep, rich soil. It will grow well in a fresh, shallow, moderately porous soil, whether fertile or not, and will thrive in comparatively dry situations. In common with our native spruces, it is shade-enduring and forms dense stands which protect the soil and maintain forest conditions.

Plantations are best started with 3-year-old trees, one year trans-

planted. The trees should ordinarily be set 4 or 5 feet apart each way. Norway spruce makes excellent development in pure stands. If planted in mixture with other species, the best associates are white pine, red pine, European larch, and chestnut.

CHESTNUT (*Castanea dentata*).

Of the hardwood trees suitable for planting in this region, chestnut is the best, since it provides quick returns in timber valuable for a wide range of uses. Large areas throughout the East, particularly in New England, Pennsylvania, and New York, are well adapted to chestnut. It does not occur naturally in the northern portions of New York, Vermont, New Hampshire, and Maine, but is abundant throughout the remaining portion of the region. If planted too far north, the shoots fail to become woody before they are nipped by the early frosts. The tree will endure the heat and cold of its natural home, however, and will remain thrifty in sunny, dry situations.

Chestnut timber is in great demand. The wood works easily and is very durable in contact with the soil. It is used in cabinet work and cooperage and for fence posts, telegraph and telephone poles, ties, and mine timbers. The presence of tannin in the wood increases the demand for small-sized and inferior material, and large quantities are used in the manufacture of tannin extracts.

Chestnut will thrive on a variety of soils, from almost pure sand to coarse gravels and shales. On limestone soils, however, it never makes good growth. In general it prefers the dry, well-drained, rocky land of the glacial drift to the richer, more compact, alluvial soils of the lowlands.

The trees should be planted 6 feet apart each way. If they are to be grown directly from the seed without transplanting, seed spots should be prepared. Two or three nuts should be planted in each and covered about 1 inch deep with fine earth. Only one tree should be allowed to remain in each hill. This method is recommended by many, and, where there is no danger from squirrels, it will prove satisfactory and less expensive than the use of seedlings. In general, however, the planting of 1-year-old seedlings will be safer and will give better results.

The system of management best suited to chestnut is the pure coppice with a rotation of twenty-five to thirty-five years. Sprouts make more rapid growth than seedling trees, and produce timber in many respects superior. Chestnut grows well in mixtures, particularly with white pine, red pine, and European larch, and with the oaks, ashes, and maples.

RED OAK (*Quercus rubra*).

Red oak exceeds all other oaks in rapidity of growth. It is recommended for planting throughout the region, with the exception of the extreme northern portion, on soils of medium quality and on those which have become exhausted by cultivation.

Red oak is inferior to white oak in strength and durability, though it is often substituted for it. It is used for cabinet work and interior finish. By far the greatest argument in favor of planting red oak, however, is the possibility of substituting its timber for that of white oak in cross-ties. White oak is not suitable for commercial planting in this region, since its slow growth makes such planting unprofitable. Although an excellent tie timber, red oak is not durable in contact with ballast. By the use of wood preservatives, however, a red oak tie can be made more durable than one of untreated white oak.

Red oak is best suited to porous sandy or gravelly clay soils. The tree is intolerant of shade, except when very young, and must always be allowed to keep its crown free.

Plantations are best established by the use of 1-year-old seedlings. The trees should be planted 6 feet apart each way. It is often advisable and less expensive to plant the acorns in seed spots in their permanent place in the field. The acorns are bitter and are not likely to be molested by squirrels. Three or four acorns should be placed in each spot and covered with about one inch of fine earth.

Red oak may be grown in pure stands, but it is suitable for mixture with white pine, European larch, red pine, and with hardwoods, such as chestnut and sugar maple.

SUGAR MAPLE (*Acer saccharum*).

Sugar maple is a comparatively slow-growing tree. It may be planted throughout the Northeastern and Lake States, on moderately rich, well-drained soils. It can not maintain itself on poor dry ground.

The wood of sugar maple is used in large quantities for flooring and interior finish and in the manufacture of woodenware, spindles, and novelties. It has a very high fuel value and produces high-grade charcoal. Sugar maple is also used to a considerable extent in the manufacture of implements and vehicles.

Sugar maple has great worth as a filler in plantations of more valuable rapid-growing trees. Its wide planting range, hardiness, tolerance, and heavy crown make it well suited for this purpose. By planting the more valuable species in mixture with sugar maple, the cost of the stand at maturity is reduced, since maple seedlings are

cheap and easily obtained. To secure proper form development it is often necessary, in forest planting, to set out a much greater number of plants than can remain on the area when the trees increase in size. It is obvious, therefore, that the temporary portion of the stand should represent as small an outlay as possible, since little returns can be expected from this source.

Sugar maple may be planted in mixture with white pine, red pine, European larch, tamarack, chestnut, and red oak. Two-year-old seedlings are suitable for planting, and may be obtained at a cost much less than that of species with which they will be associated.

Approved:

JAMES WILSON,
Secretary of Agriculture.

WASHINGTON, D. C., *May 21, 1907.*

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